General comments

This manuscript presents valuable measurements of soil respiration in a semi-arid agricultural setting. In general, the work highlights many of the challenges in measuring and interpreting semi-arid soil respiration. The authors demonstrate a strong grasp of the literature relevant to semi-arid olive plantations, and the potential competing factors influencing soil respiration. Unfortunately, the organization of the introduction and discussion does a disservice to the data presented. The topics introduced range widely, with the four stated objectives (lines 92-96) ranging widely from presenting specific data, to interpreting driving mechanisms, to comparing eddy covariance models. The manuscript feels caught between exploring soil mechanisms on one hand, and upscaling to the ecosystem level on the other. The comparison between chamber measurements and eddy covariance, while in principle a relevant topic, is underdeveloped, even to the point of distraction from the main contributions of the manuscript. Conversely, the interesting scientific contributions on the driving mechanisms of soil respiration are understated in the scientific arc of the manuscript. These should be further developed with analysis, potentially leading to much more satisfying conclusions on the role of heterotrophic vs rhizosphere respiration, and also the interplay between moisture and temperature. Additionally, I would be particularly interested in further discussion of mechanisms by which the tree itself drives factors that influence Rs. I suggest the acceptance of this manuscript with minor revisions to improve the scientific organization and to further the analysis and interpretation of potentially enlightening data.

Specific comments
- 19-20: The mention of EC model performance feels out of place in the abstract, especially since the daytime and nighttime models are not otherwise mentioned in the abstract. This is emblematic of the rest of the manuscript, where the EC contribution is potentially interesting, but not developed sufficiently to address scientific questions.
- 37-50: The discussion of mediterranean climate, climate change, and drivers of Rs is hard to digest all at once. I suggest introducing Rs drivers, the mediterranean climate, and potential climate change as separate topics.
- 64: The Birch effect is introduced in name, but not in terms of mechanisms relevant to the paragraph - further discussion of mechanisms, such as the Birch effect, would greatly increase the applicability of this research.
- 69 and elsewhere: the power of semi-continuous measurements vs measurement campaigns is apparently true, but not sufficiently developed here. The discussion of maximum variability in the discussion section is not necessarily convincing. It would be nice to see some analysis or at least discussion on how continuous measurements improved either the understanding of mechanisms or the upscaling efforts.
- 92-94: These aims feel both too wide and too overlapping. I think the entire manuscript could be strengthened significantly by focusing these aims, and adjusting the introduction and discussion accordingly.
- Rain pulse events: Section 2.5, 3.1, and 3.4. The role of rain-pulse events becomes one of the main themes of the paper, but it is relatively unmentioned in the introduction. The concept should be better introduced in the introduction, which would also strengthen the discussion and interpretation of mechanisms. Particularly, I would be interested to read

the author's discussion on the role of mechanical porespace displacement vs increased respiration. I also thought the discussion of types of rain events was excessive, e.g. Figure 4 and lines 248-257.

- Section 3.3: Q10 variability is discussed using only the Ts and SWC data from 5cm depth. Hysteresis is mentioned, but further discussion is warranted on the role of time lags for temperature and water to propagate through soil. This is relevant also for the discussion of rain pulses.
- Tree-alley dichotomy: The data very nicely examines the gradient of temperature, moisture, and Rs going between the tree and the alley. Especially given how nice the data appears, this seems like it would be a great opportunity to investigate the mechanistic role of the tree on Rs and its drivers. I was also wondering about why it was necessary to identify a tree-alley dichotomy, when it appears so nicely represented as a continuous transition.
- Figure 5 and Discussion 430-447: The discussion of VPD and plant-Rs relationships is interesting, but not necessarily convincingly supported by the data shown in figure 5. This would feel better supported if the role of root exudates were introduced as a potential mechanism in the introduction.
- Figure 6, and elsewhere: Why are Rs and SWC reported as ratios between the two locations, while temperature is the simple difference? This was also bothering me elsewhere in the manuscript, where ratios may not have been appropriate, as in comparing Rs spatial variability when all the emissions are quite low.
- 391-409: This section particularly feels underdeveloped. It is apparent that neither model is perfectly representing the ecosystem, but the mechanisms are unclear. I feel it is premature to suggest using the flawed models, perhaps it would be better to identify this as an area requiring further research on modeling mechanisms.
- 468-470: The discussion of why EC did not pick up the Birch effect is quite interesting, but it is difficult to think why EC would not be real-time. Perhaps this is also best left as an area for future research.

Technical corrections
Generally here are some paragraph-level organizational comments:
- Lines 20-21, those are two relatively big and unrelated findings that don't fit well together in one sentence.
- 31: Not clear what is set of carbon fluxes is being referenced with 'second largest'
- 239: 'y' should be translated to 'and'
- 267: Not clear what trend "the trend in Rs" is referring to
- 280 and elsewhere: "compartments" may not be the right word to refer to different chamber settings.
- 405: It is expected that lasslop et al. (2010) would have greater…
- 486: Rs_alley should be subscripted